

## STUDIES ON SPERMATOGENESIS IN SCORPIONS\*

### I. Numbers of Chromosomes in Male Germ-Cells of Three Species of Scorpions

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The present paper deals with the chromosomes of three species of scorpions, including two species, *Centruroides vittatus* and *Buthotus tamulus*, of family Buthidae, and one species, *Heterometrus gravimanus* of family Scorpionidae. A survey of papers on this subject by other workers i.e. Sokolow (1913), Wilson (1916, 1931, 1937) and Sato (1940) indicated that chromosome numbers in these species have not previously been studied.

#### Materials and Methods

Living specimens of *Heterometrus gravimanus* and *Buthotus tamulus* were obtained from a commercial source in Bombay, India. Examples of the Texas scorpion, *Centruroides vittatus*, were sent from the Entomology Branch, Department of Preventive Medicine, Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston, Texas.

Testes of adult male scorpions were water treated by the Makino and Nishimura technique (1950), and immediately thereafter were fixed with Newcomer's solution and stained with 5% Acetic Orcein. These preparations were placed on a slide, squashed with a cover slip, and sealed under the slip with paraffin. These testes preparations were then examined under oil-immersion at a magnification of 2000X.

#### Results

##### *Heterometrus gravimanus*

Haploid chromosomes numbering 27 were clearly observed in both primary and secondary spermatocytes. These appeared as shown in Figure 1.

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Fig. 1 *Heterometrus gravimanus*  
Chromosomes in metaphase-primary spermatocyte.

*Buthotus tamulus*

Haploid chromosomes, 12 in number, were seen in both primary and secondary spermatocytes. The diploid number of 24 chromosomes was observed in spermatogonial cells near the testis wall. Figures 2 and 3 are drawings showing both the haploid and diploid conditions.



Fig. 2 *Buthotus tamulus*  
Chromosomes in metaphase-primary spermatocyte.



Fig. 3 *Buthotus tamulus*  
Chromosomes in metaphase-spermatogonial cell.

*Centruroides vittatus*

Primary and secondary spermatocytes, without exception, showed 11 haploid chromosomes at metaphase. The diploid number, 22 chromosomes, was observed in spermatogonial cells. Both conditions are shown in Figures 4 and 5.



Fig. 4 *Centruroides vittatus*  
Chromosomes in metaphase-primary spermatocyte.

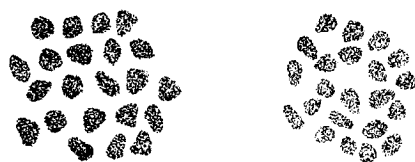


Fig. 5 *Centruroides vittatus*  
Chromosomes in metaphase-spermatogonial cell.

## Discussion

Although there are relatively few papers dealing with scorpion chromosomes, a rather surprising variation in numbers has been reported. In some instances

Table I Chromosome Numbers in Scorpion Male Germ-Cells

Species	Chromosome Numbers		Authority
	2n	n	
Family Buthidae			
<i>Isometrus maculatus</i>	12	♂ (I)** 6 ♂ (II)**	*Piza 1947
<i>Tityus matoogrossensis</i>	20	10 ♂ (I, II)	"
" "	—	14, 9, 8 ♂ (II)	"
<i>Tityus serrulatus</i>	12	—	"
<i>Tityus trivittatus</i>	14	♂ (I) 7 ♂ (II)	*Piza 1948
<i>Mesobuthus eupeus</i> ( <i>Buthus</i> )	about 22	—	Sokolow 1913
<i>Mesobuthus martensii</i> ( <i>Buthus</i> )	24	12 ♂ (I, II)	Sato 1940
<i>Centruroides exilicauda</i>	26	13 ♂ (I)	Wilson 1916, 1931
<i>Tityus bahiensis</i>	6	3 ♂ (I, II)	*Piza 1937, 1941, 1943, 1944, 1946, 1957
" "	7	1 heptavalent, ♂ (I) 3, 4 ♂ (II)	*Piza 1948
" "	10	5 ♂ (I, II)	"
" "	20	10 ♂ (II)	"
Family Scorpionidae			
<i>Opisthacanthus elatus</i>	about 60-62	—	Wilson 1916, 1931
<i>Scorpio occitanus</i>	—	22-28 ♂ (I)	*Carnoy 1885
Family Bothriuridae			
<i>Bothriurus</i> sp.	36	—	*Piza 1947
Family Chactidae			
<i>Euscorpius carpathicus</i>	70-34	28-40 ♂ (I, II)	Sokolow 1913
Family Vejovidae			
<i>Hadrurus hirsutus</i>	about 100	about 50 ♂ (I)	Wilson 1931
<i>Vejovis boreus</i>	about 100	about 50 ♂ (I)	"

\* Papers by Piza and Carnoy were not available for study. Authority for all results attributed to these workers was Makino (1956).

\*\* In all citations the number I indicates primary spermatocytes and II indicates secondary spermatocytes.

different numbers of chromosomes have been described for the same species of scorpion by the same investigator i.e. for *Tityus bahiensis* as reported by Piza (1937, 1941, 1943, 1944, 1946, 1947, 1948). These reported variations were undoubtedly due to differences in technique and perhaps in condition of available study material.

Results obtained by earlier workers on this problem are summarized in Table I.

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\* Cited in MAKINO (1956)—(Number 2 in this reference list.)